

electrically interconnecting the electronic control system and the at least one electrofluidic component. Independent claims 38, 40, and 44 recite similar features.

The innovative design of the integrated electrofluidic system utilizes a commercially available, low cost polymer material with a thin layer of adhesive which is machined and processed to define microfluidic and/or electronic components directly on the polymer material of the platform. Additional layers of the polymer/adhesive material are added and additional microfluidic and/or electronic components may be defined. The layers are then modified with a thin layer of adhesive which efficiently seals and bonds the layers. The result is an integrated electrofluidic system which is embedded in the support platform and includes microfluidic and/or electronic components. The system also incorporates an electrical conductor embedded between the layers and carried by the platform to provide an interconnection between the electrical components and the microfluidic components. The claimed electrofluidic system includes a microfluidic system embedded in the support platform that provides an interconnection between various electrofluidic components, e.g., a filter, dispenser reactor, heater concentrator, cooling device, flow sensor, temperature sensor, chemical sensor, biological sensor, and the like, that includes an input and an output. The innovative integrated electrofluidic system as recited in claim 1 efficiently circulates fluid over various electrofluidic components and sensors that may be embedded within the fluidic channels. *See* applicants' specification, page 11, lines 21-23.

In contrast, Zdeblick teaches and discloses an electric to fluidic valve that includes a membrane chamber which is etched into the substrate: "The valve is comprised of a membrane chamber 10 which is etched into a substrate 12 of [100] orientation silicon in the preferred embodiment." (Col. 6, lines 34-35) The membrane chamber is a fixed volume defined by six walls: "The membrane chamber 10 is defined by six walls, four of which are

silicon [111] planes and two of which, walls 14 and 16, are shown in cross section.”

(Col. 6, lines 55-57) The electro-to-fluidic valve as taught and disclosed by Zdeblick flexes member 18 in responses to changes in the fixed fluid volume within the membrane chamber 10. The necessary change in fluid volume is created by either a light energy from a light pipe or from a resistor element to which electrical current is passed. *See* col. 6, line 64 – col. 7, line 19. The corresponding change to the contents of membrane chamber deflects causing membrane 18 to sit on sealing ring 18 thereby cutting off all the pneumatic flow through the nozzle. *See* col. 8, lines 24-40.

Zdeblick also teaches and discloses that the membrane chamber may be filled with a gas or fluid through a port which is then sealed: “This filling may be done while the pyrex wafer 22 is being attached, or after attachment by means of forming a port into the membrane chamber 10, filling the chamber with gas or fluid, and then sealing the port.”

(Col. 8, lines 1-5, emphasis added)

More proof that Zdeblick teaches a fixed volume of fluid in the membrane chamber is shown by: “In embodiments where there is no danger of reaction between the heating element and the material trapped in the membrane chamber, the coating may be omitted.” (Col. 7, lines 61-64, emphasis added). Clearly, Zdeblick teaches and discloses an electro-to-fluidic valve that includes a membrane chamber that has a fixed volume of fluid which is expanded by a light source or a resistive element to deflect a membrane to provide a fluidic valve.

As shown above, Zdeblick does not teach, suggest, or disclose each and every element of the applicants’ invention as recited in claim 1, namely, a microfluidic system embedded in the platform and having an input and output and at least one electrofluidic component. Accordingly, claim 1 is patentable and allowable under 35 U.S.C. 102(b) over

Zdeblick. Independent claims 38, 40, and 44 include all of the same features as claim 1 and are therefore are allowable and patentable over Zdeblick. Because dependent claims 2, 3, 9, 11, 13, 15-17, 19, 21-22, 34-36, 39-41, and 45 depend from allowable base claims, these claims are allowable and patentable over Zdeblick.

The Examiner rejects claims 10, 12, 14, 18, 20, 23-33 and 42-43 under 35 U.S.C. §103(a) as being unpatentable over Zdeblick. The Examiner also rejects claims 5-8 under 35 U.S.C. §103(a) as being unpatentable over Zdeblick in view of Bergstresser *et al.* As shown above, Zdeblick does not teach, suggest or disclose each every element of the applicants' invention as recited in applicants' independent claims 1, 38, and 40. Because claims 5-8, 10, 12, 14, 18, 20, 23-33, and 42-43 depend from allowable base claims, the Examiner's rejections of these claims under 35 U.S.C. §103(a) is traversed.

The Examiner rejects claims 1 and 37 under 35 U.S.C. §102(e) as being anticipated by Morse *et al.*

However, in contrast to the applicants' claimed microfluidic system described above, Morse *et al.* teaches and discloses a MEM based fuel cell package that is comprised of seven layers that include a subpackage fuel reservoir layer, an anode layer, a fuel anode manifold, a resistive heater layer, a thick film microporous flow host structure layer with a fuel cell, an air manifold layer, and a cathode manifold support layer and a cap. The seven stacked layers form a path for air and fuel flow through the fuel cell package. *See* col. 4, lines 51-60. However, nowhere in the entire disclosure of Morse *et al.* is there any teaching, suggestion, or disclosure of 1) an electronic control system mounted on a support platform, 2) a microfluidic system embedded in the platform having an input and an output and at least one electrofluidic component, and 3) at least one electrical conductor carried by

the platform for electrically interconnecting the electronic control system and the at least one electrofluidic component.

Accordingly, independent claim 1 is allowable and patentable under 35 U.S.C. 102(e) over Morse *et al.* Because claim 37 depends from claim 1, claim 37 is also allowable and patentable over Morse *et al.*

The Examiner rejects claims 1-4 under 35 U.S.C. 102(e) as being anticipated by Barth *et al.* The Examiner alleges that Barth *et al.* discloses a microfluidic device as claimed that includes a Kapton film.

The applicants respectfully disagree with the Examiner that Barth *et al.* discloses each and every element as recited in applicants' claim 1. Barth *et al.* teaches and discloses a fluid handling system that is fed from hundreds of different reservoirs that deposits hundreds of different fluids in the form of drop-on-demand droplets onto substrates. The fluid handling system of Barth *et al.* relies on a microtiter manifold, a reservoir, liquid access holes and a capillary between two sheets to deliver fluid to a deposition chip (108) which carries the ejection means (110). See Col. 4, line 40 – Col. 5, line 6.

In operation, a droplet is ejected by the fluid handling system through a passthrough hole by the ejection means 110 mounted on deposition chip 108. The droplet is then deposited on a substrate: “In operation, a droplet 144, which has a typical volume of 35 picoliters (p1), is ejected from the fluid handling system 100 through droplet passthrough hole 142 after being ejected from the orifice 138 by ejection means 110.” (Col. 5, lines 7-10)

Although the Examiner alleges that Barth *et al.* teaches and discloses an electrofluidic component, e.g., deposition chip 108, that carries ejection means 110, Barth *et al.* does not teach, suggest, or disclose an electronic control system mounted on a

platform. Barth *et al.* also fails to teach, suggest or disclose and at least one electrical conductor carried by the platform for electrically interconnecting the electronic control system and the at least one electrofluidic component, as recited in applicants' independent claim 1.

Accordingly, claim 1 is allowable and patentable under 35 U.S.C. 102(e) over Barth *et al.* Because claims 2-4 depend from an allowable base claim, these claims are allowable and patentable under 35 U.S.C. 102(e) over Barth *et al.*

Each of the Examiner's rejections has been addressed or traversed. Accordingly, it is respectfully submitted that the application is in condition for allowance. Early and favorable action is respectfully requested.

If for any reason this Response is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates, collect in Waltham, Massachusetts, at (781) 890-5678.

Respectfully submitted,



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